



**You have downloaded a document from  
RE-BUŚ  
repository of the University of Silesia in Katowice**

**Title:** Smart university in smart society – some trends

**Author:** Eugenia Smyrnova-Trybulska

**Citation style:** Smyrnova-Trybulska Eugenia. (2018). Smart university in smart society – some trends. W : E. Smyrnova-Trybulska (red.), “E-learning and Smart Learning Environment for the Preparation of New Generation Specialists” (S. 65-80). Katowice : Studio Noa



Uznanie autorstwa - Użycie niekomercyjne - Bez utworów zależnych Polska - Licencja ta zezwala na rozpowszechnianie, przedstawianie i wykonywanie utworu jedynie w celach niekomercyjnych oraz pod warunkiem zachowania go w oryginalnej postaci (nie tworzenia utworów zależnych).



UNIwersYTET ŚLĄSKI  
W KATOWICACH



Biblioteka  
Uniwersytetu Śląskiego



Ministerstwo Nauki  
i Szkolnictwa Wyższego

# SMART UNIVERSITY IN SMART SOCIETY – SOME TRENDS

**Eugenia Smyrnova-Trybulska**

University of Silesia in Katowice

Bankowa 12, 40-007 Katowice, Poland

Faculty of Ethnology and Sciences of Education

Bielska 62, 43-400 Cieszyn

esmyrnova@us.edu.pl

**Abstract:** *It is one of the responsibilities of universities to develop students' work readiness. A smart university, as part of a smart city, is no longer limited to providing technologies inside and outside classrooms. Such a general scenario and the preceding statement confirms the thesis at the basis of this study: there is a need for a change of the current model of the modern university from smart to smarter. E-learning is a global category and all kinds of institutions need highly qualified specialists and staff that can handle different working cultures and have an international open-minded perspective. In the last part of the article the author describes an example of an innovative MA Programme for preparing new generation specialists.*

**Keywords:** smart society, smart environment, smart university, new generation specialists

## INTRODUCTION

The development of communication channels and means of communication and information exchange is leading to a new world of the "evolutionary spiral", the transformation of the information society into what is nowadays commonly referred to as smart society. Such a policy, a strategy to be adopted at the international level, is now perceived as the only possible solution in the modern world. An intelligent society more accurately expresses the intention to improve all aspects of human life, using ICT in new industries.

This policy has become a model for the United States - a leader in the online world, as well as for European countries, Japan, Korea and many other countries. A smart society is a new quality of society, in which properly supported equipment, services provided and access to the Internet lead to qualitative changes in the interaction of subjects, which allows for achieving new results - social, economic

and other benefits. This is the next stage in the development of the so-called information society in which we live today.

The Internet blurs the boundaries of the economy, society and industry, changing the rules of the game, increasing the likelihood of risk as well as new opportunities. Smart is the property of an object, characterized by the integration of two or more elements in this object that were not previously connected. This is done via the Internet, for example a smart TV, a smart house, a smartphone. Smart technology will lead to the development of labour mobility: in education, in the service of the state, and in many other areas of employment (Tihomirova 2012).

The use of technological devices has changed the way the individual interacts with the university environment. A study (Nuzzaci, La Vecchia 2012) analysed the use of intelligent technologies as a link between people and their university environment, illustrating important problems in various fields and technological systems, as well as the use of information and communication devices used at universities, in the context of teaching-learning to improve the quality of higher education and personal cultural life. The authors ask the question: when does the university become "intelligent"? It is not enough for universities to define themselves as intelligent places. Addressing major challenges, they must face up to the challenge of becoming strong and intelligent in reality not only thanks to intelligent systems, but also as a smart, knowledgeable university community that provides high quality education and research. (Nuzzaci, La Vecchia 2012).

## 1. BACKGROUND AND TAXONOMY OF SMART

There are several fields of activity which are described in literature in relation to the term *Smart City*: industry, education, participation, technical infrastructure, various 'soft factors'; in Giffinger (2007: 10-11) six characteristics are identified as a roof for the further elaboration of smart cities which should incorporate the findings but also allow for an inclusion of additional factors, such as: *Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, Smart Living*.

Research, design, and development of smart universities, smart education, smart classrooms, smart learning environments, smart pedagogy, smart learning and academic analytics, and related topics became the main themes of various pioneering international and national studies, events and projects, governmental and corporate initiatives, institutional agendas, and strategic plans (Heinemann, Uskov 2018).

A study (Heinemann, Uskov 2018) presents the outcomes of an ongoing project aimed at a systematic literature review and creative analysis of professional publications available in those areas. The premise is that the outcomes of the systematic creative analysis performed will enable researchers to identify the most effective and well-thought ideas, approaches, developed software and hardware

systems, technical platforms, smart features and smartness levels, and best practices for the next evolutionary generation of a university—a smart university. The Smart Maturity Model presented can be viewed as an evolutionary approach for a traditional university to progress to various levels of the maturity of smart university.

According to experts: “Education in a smart environment supported by smart technologies, making use of smart tools and smart devices, can be considered smart education... . In this respect, we observe that novel technologies have been widely adopted in schools and especially at universities, which, in many cases, exploit cloud and grid computing, Next Generation Network (NGN) services and portable devices, with advanced applications in highly interactive frameworks ... smart education is just the upper layer, though the most visible one, and other aspects must be considered, such as: (1) communication; social interaction; (3) transport; (4) management (administration and courses); (5) wellness (safety and health); (6) governance; (7) energy management; (8) data storage and delivery; (9) knowledge sharing; (10) IT infrastructure; (11) Environment.” (Coccoli et al., 2014: pp. 1004).

The concept presented by Tikhomirov, Dneprovskaya (2015) is as follows: “Intelligent University is a concept that includes a comprehensive modernization of all educational processes. [...] Intelligent education is able to reach a new university where the use of ICT and the activities of lecturers lead to a completely new variety of processes and results of educational, research, commercial and other activities, university activities. [...] The Smart concept in education entails the emergence of technologies such as smart boards, smart screens and wireless internet access from anywhere.” (Tikhomirov, Dneprovskaya 2015: 4).

“*Smart University* is a concept that involves a comprehensive modernization of all educational processes. ... The *smart education* is able to provide a new university, where a set of ICT and faculty leads to an entirely new quality of the processes and outcomes of the educational, research, commercial and other university activities. ... The concept of *Smart* in education area entails the emergence of technologies such as smart boards, smart screens and wireless Internet access from everywhere”. (Tikhomirov, Dneprovskaya 2015: 4).

Ecosociety, the knowledge society, the digital society are transforming into an intelligent society. It is built on “smart” work, which is done by “intelligent” government and business representatives, based on “intelligent” infrastructure and “intelligent” citizens, playing a key role in creating intelligent culture. In addition, the priority is the development of such industries as smart transport, smart health, smart energy, smart food, etc., which will eventually lead to the creation of a smart world.

Hwang (2014) presented a concept of intelligent learning environments that can be considered as a learning environment supported by technology. They introduce adaptations and provide appropriate support (for example tips, feedback or helpful

tools) at the right places and at the right time for individual students' needs, which can be determined by analysing their educational behaviour, results, as well as the online and real context in which they are located.

L.F. Kwok (2015) defines Smart, *intelligent campus (i-campus)* as "... a new paradigm of thinking pertaining to a holistic intelligent campus environment which encompasses at least, but not limited to, several themes of campus intelligence, such as holistic e-learning, social networking and communications for work collaboration, green and ICT sustainability with intelligent sensor management systems, protective and preventative health care, smart building management with automated security control and surveillance, and visible campus governance and reporting".

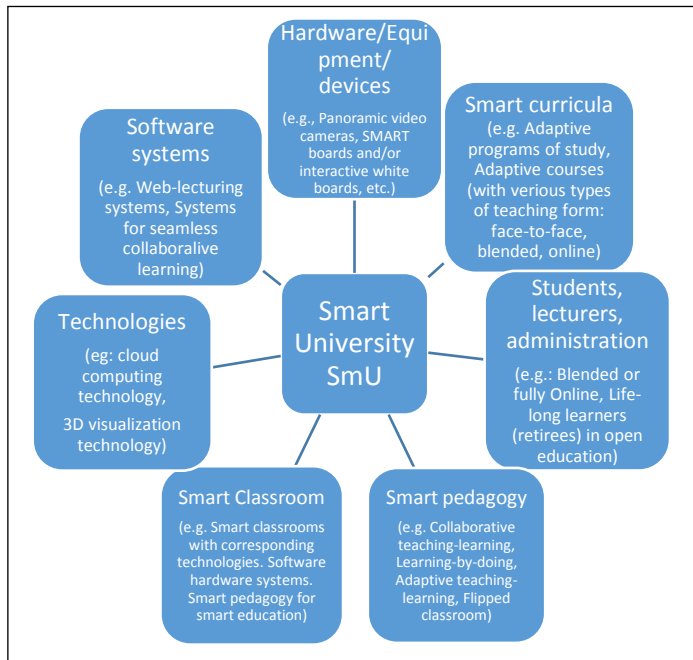
A smart university is part of a smart city. A smart university is defined as "a platform that acquires and delivers foundational data to drive the analysis and improvement of the teaching & learning environment" (Roth-Berghofer, 2013). It is suggested that "a smart university should have tools, similar to those suggested in the European Competence Framework (ECF) framework, to build educational profiles and consequently, curricula and courses that both adhere to the standards required by the scientific and professional communities (e.g., IEEE, ACM)" (Coccoli, Guercio, Maresca, Stanganelli 2014).

In a smart society, technologies, previously based on information and knowledge, are transformed into technologies based on interaction, cooperation, exchange of experiences - smart technologies. Citizens, new generation specialists, turn their activities into "smart" and implement innovative changes in management strategies. This means that society needs more creative and open thinking, so that human dignity, based on flexibility and originality, is a priority. The most important issue is the training of staff with creative, creative potential, able to work and think in the new world. Therefore, the ability to quickly and efficiently find and use information is essential to be considered an intelligent person who has the necessary information competences.

A specialist who has no practical skills to work in social networks with electronic sources and who cannot develop her/his knowledge base will be ineffective and therefore will not be desirable (Tihomirova 2012).

In (Kwok, Hui 2018) the role of e-portfolio for Smart Life Long Learning is described. Experts, in particular, stressed that "a smart university, as part of a smart city, is no longer limited to providing technologies inside and outside classrooms". The authors discuss "how a smart university may facilitate self-regulated learning of learners through the introduction of personal development e-Portfolio, which assists learners in planning their development path and reflecting upon their own learning. An implementation example in the City University of Hong Kong is reviewed. Also, the way of extending it to lifelong and professional development is discussed." (Kwok, Hui 2018: pp. 327)

Figure 1 illustrates the main components of a smart university (SMU).



**Figure 1. Smart university (SMU) main components**

*Source: Own work based on Uskov et al. (2016).*

Preparing a specialist who has professional skills and habits in a smart society is a task for the smart university. This is a university where the use of a complex (set) of technological innovations and the Internet by trained people leads to a new, appropriate intelligent society, to improvements in the quality of educational, scientific and research, commercial, social processes as well as other activities. According to the Europe 2020 document, "Intelligent development means achieving better results in the field of:

- education (encouraging to study, study and improve qualifications);
  - scientific research / innovation (creation of new products and services that would have an impact on accelerating economic growth and employment and would help in solving social problems);
  - a digital society (use of information and communication technologies)."
- ([http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/priorities/smart-growth/index\\_en.htm](http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/priorities/smart-growth/index_en.htm) [accessed: 12/02/2017]). EU goals for ensuring smart development include:

- increasing the total level of public and private investment to 3% of EU GDP, as well as ensuring better conditions for R&D and innovation;
- increasing the employment rate of women and men aged 20-64 to 75% by 2020 as a result of introducing more people to the labour market, especially women, youth, the elderly, low-skilled workers and legal immigrants;
- ensuring a better level of education;
- lowering the percentage of early school leavers to below 10%;
- striving, by at least 40% of people aged 30-34, to have a university degree (or equivalent) ([http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/priorities/smart-growth/index\\_en.htm](http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/priorities/smart-growth/index_en.htm) [accessed on 11.01.2017]).

The EU documents present an agenda of activities. The EU will support smart development through three flagship initiatives:

1. The Digital Agenda for Europe - creating a digital single market based on fast and ultra-fast internet and on applications interoperability:

- until 2013: broadband Internet access for everyone;
- by 2020: access for all to connections with a much higher data transmission speed (30 Mb/s and more);
- by 2020: access to lines with speeds above 100 Mb/s for at least 50% of European households.

2. Innovation Union:

- using R&D and innovation to address the most serious problems that our society faces, such as climate change, energy efficiency and resource efficiency, health protection and demographic change;
- strengthening each element of the innovation process, from initial research projects to the commercial use of their results.

3. Mobile youth:

- making it easier for students and trainees to study abroad;
- better preparation of young people to start on the labour market;
- improving the results and increasing the attractiveness of European universities;
- improvement of all levels of education and training (high academic level, equal opportunities).

There are arguments and justification why Europe needs smart development. Europe's lower growth compared to its major competitors is largely due to the differences in performance levels caused in part by:

- lower level of investment in research and development and innovation;
- insufficient use of information and communication technologies;
- difficult access for some groups of society to innovation.

Here are some examples:

- European companies currently only have a 25% share in the world market of information and communication technologies worth EUR 2 billion.
- The slow introduction of high speed Internet access has a negative impact on the European potential for innovation, the dissemination of knowledge and the distribution of goods and services, and also leads to the isolation of rural areas.

Unfortunately, we cannot provide very optimistic data on the level of education of today's young people. About 25% of European school pupils cannot read well. Too many young people are dropping out without any qualifications. Admittedly, statistics on people who acquire qualifications at the secondary level seem to be more optimistic, but these qualifications often do not match the market needs. Only a third of Europeans aged 25-34 have a university degree (40% in the United States, over 50% in Japan). European universities occupy weak positions in world rankings - only 2 of them were on the top 20 list (see the Shanghai ARWU ranking).

## 2. CURRENT AND FUTURE TRENDS IN EDUCATION

To conclude this brief analysis of related works, we mention the reports published by the New Media Consortium (NMC) (<http://nmc.org>), which contain interesting outlooks on trends in education and a perspective timeline for their adoption. For example, the 2012 edition (L. Johnson, S. Adams, M. Cummins, NMC Horizon report: 2012 higher education edition, 2012) predicted the success of mobile apps and tablet computing within one year or less, game-based learning and learning analytics adoption was indicated on a two to three years horizon, while gesture-based computing and the Internet of the Things (IoT) on a four to five years horizon. We still need time to see whether these estimates will be fully realized or not.

In the 2013 edition (Johnson et. al, 2013), the main focus was on the success of Massive Open Online Courses (MOOC) in one year and new issues are 3D printing and wearable technology on a four to five years horizon.

The current 2014 edition (Johnson et. al, 2014) highlights the key trends that are driving changes in higher education in the next years. Among these is the growing ubiquity of social media, the integration of online, hybrid and collaborative learning environments, the rise of data-driven learning and assessment, the shift from students as consumers to students as creators (a shift that will mark the



definitive evolution of online learning). It is worth noting that in this work, the authors indicate the “*low digital fluency of faculty*” and the “*lack of rewards for teaching*” as challenges to be solved. (Coccoli, Guercio, Maresca, Stanganelli, 2014, pp. 1005)

This general scenario and these preceding statements confirm the thesis at the basis of this study: there is a need for the change of the current model of the modern university from smart to smarter. Table 1 helps to analyse Report 2012-2017 and compare Key Trends and Challenges Accelerating Technology Adoption in Higher Education

**Table 1:**

**Key Trends and Challenges Accelerating Technology Adoption  
in Higher Education**

	2012	2013	2014	2015	2016	2017
<b>Key Trends Accelerating Technology Adoption in Higher Education</b>						
<b>Long-Term Trends:</b> Driving Ed Tech adoption in higher education for five or more years			Agile Approaches to Change  Evolution of Online Learning	Advancing Cultures of Change and Innovation  Increasing Cross-Institution Collaboration	Advancing Cultures of Innovation  Rethinking How Institutions Work	Advancing Cultures of Innovation  Deeper Learning Approaches
<b>Mid-Term Trends:</b> Driving Ed Tech adoption in higher education for three to five years			Rise of Data-Driven Learning and Assessment  Shift from Students as Consumers to Students as Creators	Growing Focus on Measuring Learning  Proliferation of Open Educational Resources	Redesigning Learning Spaces  Shift to Deeper Learning Approaches	Growing Focus on Measuring Learning  Redesigning Learning Spaces
<b>Short-Term Trends:</b> Driving Ed Tech adoption in higher education for the next one to two years			Growing Ubiquity of Social Media  Integration of Online, Hybrid, and Collaborative Learning	Increasing Use of Blended Learning  Redesigning Learning Spaces	Growing Focus on Measuring Learning  Increasing Use of Blended Learning Designs	Blended Learning Designs  Collaborative Learning

### Significant Challenges Impeding Technology Adoption in Higher Education

Solvable Challenges : Those that we understand and know how to solve	Low Digital Fluency of Faculty	Blending Formal and Informal Learning	Blending Formal and Informal Learning	Improving Digital Literacy
<b>Difficult Challenge s: Those we understand but for which solutions are elusive</b>	Relative Lack of Rewards for Teaching	Improving Digital Literacy	Improving Digital Literacy	Integrating Formal and Informal Learning
	Competition from New Models of Education	Personalizing Learning	Competing Models of Education	Achievement Gap
	Scaling Teaching Innovations	Teaching Complex Thinking	Personalizing Learning	Advancing Digital Equity
Wicked Challenges : Those that are complex to even define, much less address	Expanding Access	Competing Models of Education	Balancing Our Connected and Unconnected Lives	Managing Knowledge Obsolescence
	Keeping Education Relevant	Rewarding Teaching	Keeping Education Relevant	Rethinking the Roles of Educators

### Important Developments in Educational Technology for Higher Education

<b>Time-to-Adoption Horizon: One Year or Less</b>	Mobile Apps Tablet Computing	Massively Open Online Courses Tablet Computing	Flipped Classroom Learning Analytics	Bring Your Own Device (BYOD) Flipped Classroom	Bring Your Own Device (BYOD) Learning Analytics and Adaptive Learning	<b>Adaptive Learning Technologies</b> <b>Mobile Learning</b>
<b>Time-to-Adoption Horizon: Two to Three Years</b>	Game-Based Learning Learning Analytics	Games and Gamification Learning Analytics	3D Printing Games and Gamification	Makerspaces Wearable Technology	Augmented and Virtual Reality Makerspaces	<b>The Internet of Things</b> <b>Next-Generation LMS</b>
<b>Time-to-Adoption Horizon: Four to</b>	Gesture-Based Computing	3D Printing Wearable Technology	Quantified Self Virtual	Adaptive Learning Technologies	Affective Computing Robotics	<b>Artificial Intelligence</b> <b>Natural</b>

<b>Five Years</b>	g	Assistants	s	<b>User Interfaces</b>
	Internet of Things		The Internet of Things	

*Source: Own work based on NMC Horizon Report: 2012-2017  
Higher Education Edition*

### **3. THE PREPARATION OF NEW GENERATION SPECIALISTS IN CONDITIONS OF AND FOR SMART SOCIETY**

#### *Innovative MA Programme “E-learning in Cultural Diversity”*

Developing the innovative MA Programme “E-learning in Cultural Diversity” has several causes and conditioning factors:

- 1) Expectations of the labor market
- 2) Formal and legal changes
- 3) Positive experience in different countries
- 4) International cooperation, International projects (in particular, IRNet)
- 5) Expectations and interests from future students

The programme focuses on the development of competences in such areas as e-learning, leadership, intercultural and multicultural skills in the conditions of internationalisation and digitalisation of society. Students will acquire new competences, develop their entrepreneurial digital skills and produce high quality results which can be shared and serve as encouragement for further practice.

The programme involves the following scientific areas: 1. Social Sciences and Humanities (communication networks, media and information society to support the surroundings of heterogeneous groups); 2. Information Science and Engineering (e-learning, user modelling and collaborative systems); 3. Economic Sciences (competitiveness, management, innovation, research and development). The multidisciplinary design of this master course implies an integrated approach to follow the objectives and mission of the programme, defining the choice of partners in the process with convergence and complementarity in nature. Partners were selected based on their proficiency in the various domains.

The need analysis leading to the design of the MA course proposal rests upon four main factors:

1. Documents and statistics produced by the EU, to which various national documents are added that identify priority areas (Jobs, ICT and Learning, Environment, Cultural Diversity) important for employability and where predictions are made about future needs (gaps between demand and supply);

2. Knowledge about students' population has stimulated interest in working together, exchanging experiences and practices;
3. Connection between the market needs and the student's expectations;
4. Opinions stated by stakeholders (partners from study centres and the business world) who were asked to give opinions on the design of the programme curriculum.

The programme is not exclusively focused on ICT as an end but is based on ICT both as means and tools to help build knowledge in any area, particularly in Europe's priority areas, keeping in mind society's sustainability and well-being.

The programme is innovative as it encourages students to look at society and environment, namely by stressing the importance of the past and re-using good ideas and practices.

"Cultural diversity" is another item, stressed as inclusion, that is considered in its broader sense, not only in respect of gender differences or disadvantaged citizens. It is the capacity for valuing the primacy of accessibility and usability to reach everybody. "Promoting through education an awareness of the positive value of cultural diversity and improving to this end both curriculum design and teacher education." (UNESCO 2002).

The ideas for the proposed innovative course are presented in a few fields:

- the graduate obtains a deep interdisciplinary knowledge and adequate skills within the module groups of humanities and social sciences,
- the curriculum subjects will employ the modern IT and ICT for more individualised educational process in e-learning and blended learning mode. Also planned is national and international mobility of lecturers and students,
- a vital role in preparing students for future jobs plays tutoring connected with practical usage of skills.

The Faculty of Ethnology and Educational Science (US) has been cooperating for many years, *inter alia*, with the local environment, with the community of teachers and numerous institutions. This has allowed for tracking the labour market, social needs, employers' and students' expectations. The established cooperation, monitoring graduates' careers and other activities have been performed in formal and informal dimensions. These include panel meetings with graduates as well as their participation in conferences and meetings, individual relations and contacts of employees with graduates working in educational institutions, contact with companies and enterprises. All these forms are to monitor the changing educational, economic and social needs in digital technologies in the conditions of globalisation, internationalisation, mobility and creation of intercultural and cross-cultural environment.

### 1. ***Theoretical and practical aspects in distance learning conference (www.dlcc.us.edu.pl).***

The most important activities in the recent years (2009-2017) in the field of needs analysis of the labour market, monitoring the career paths and diagnosis of education effects include an annual international conference entitled: 'Theory and practice of distance education' (www.dlcc.us.edu.pl). The most important conclusion from the special sessions is the fulfilment of the basic qualification requirements needed by the graduates. It is connecting work with e-learning in educational institutions and private enterprises. This formal requirement is only the beginning of supplementation of competences.

### 2. **Evaluation survey for students, teachers, employees of companies, public institutions and non-public institutions.**

The survey conducted in 2014-2015 included a description of the proposal in a new field of study. The survey was conducted in three voivodships: Śląskie, Opolskie and Małopolskie. Most of the respondents expressed a positive opinion and showed interest in the participation in the studies.

3. One of the goals and results of IRNet international project (www.irnet.us.edu.pl) is the development and implementation of an **interdisciplinary programme** supporting development of modern tools and **methods** in the information and communication technology (ICT) for pedagogic science and distance education as well as development of pedagogy in the context of intercultural competences in the **countries of the European Union, Australia, Russia and Ukraine.**

Organisations in which the students will study E-learning in Cultural Diversity include:

- educational institutions (schools, education offices, teacher excellence centres);
- distance education centres of public and non-public universities;
- state or private companies rendering educational & consulting services;
- training departments of various business sectors;
- training departments of public administration institutions;
- companies dealing with development of distance courses.

*Employability and improved career prospects.* E-learning management, digital competences, inter-, multi-cultural competences are one of the key areas the digital recovery of Europe should be based upon. The SMART institution Roadmap identifies as one of the high development areas and enables to address the major modern institutions (educational institutions as well as companies), challenges and opportunities, and it highlights the leadership in the development, adaptation and commercialisation and speeding up of the innovation processes linked to these specific issues as critical for the sustainability of European digital environment. E-learning is one of the key technologies that will underpin the development of Open

educational environment in Europe. E-learning is a global category and all kinds of institutions need highly qualified specialist and staff that can handle different working cultures and have an international open-minded perspective.

## CONCLUSIONS

A smart university could be considered a complementary system of several categories, in particular, *Smart Hardware*, *Smart pedagogy*, *Smart curricula*, *Competent Students*, *lecturers*, *administration*, *Smart Classroom*, *Technologies*, *Software systems*. Although some authors think that “Currently, universities can be regarded as smart universities, as they profitably use available technologies to improve their performance and to enhance the quality of their graduates” (Coccoli et al, 2014), simultaneously they require improvement and further development, first of all by taking into account the student's personal expectations and needs. For example, at a smarter university the ultimate technological solutions foster collaboration and cooperation among individuals. On the one hand, it is necessary to create conditions for effective study and development, to face challenges, and on the other hand, to create and prepare new generation specialists, new directions for functioning in a new smart society and smart environment that is just being created.

## REFERENCES

- Adams Becker, S., Cummins, M., Davis, A., Freeman, A., Hall Giesinger, C., and Ananthanarayanan, V. (2017). *NMC Horizon Report: 2017 Higher Education Edition*. Austin, Texas: The New Media Consortium. Retrieved from <http://cdn.nmc.org/media/2017-nmc-horizon-report-he-EN.pdf> (accessed: 23 August 2018)
- Chun, S. Lee, O.: Smart education society in South Korea. In: GELP Workshop on Building Future Learning Systems, Durban, South Africa (19-21 April 2015) Retrieved from [http://gelpbrasil.com/wp-content/uploads/2015/05/smart\\_education\\_workshops\\_slides.pdf](http://gelpbrasil.com/wp-content/uploads/2015/05/smart_education_workshops_slides.pdf)
- Coccoli, M., Guercio, A., Maresca, P., Stanganelli, L. (2014). Smarter Universities: a vision for the fast changing digital era. *J. Vis. Lang. Comput.* 25. 1003-1011
- Duhnich Y.: European Studies 2020. Smart Education, 2014. <http://www.smart-edu.com/learning-in-europe-2020.html> (accessed 23 August 2014).
- Europe 2020 Strategy. SAMRT growth. Retrieved from Retrieved from [http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/priorities/smart-growth/index\\_pl.htm](http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/priorities/smart-growth/index_pl.htm) (accessed 12 February 2017)
- Freeman, A., Adams Becker, S., Cummins, M., Davis, A., and Hall Giesinger, C. (2017). *NMC/CoSN Horizon Report: 2017 K-12 Edition*.

- Austin, Texas: The New Media Consortium. Retrieved from <https://cdn.nmc.org/media/2017-nmc-cosn-horizon-report-k12-EN.pdf> (accessed 12 February 2018).
- Future Learning Systems, Durban, South Africa (19–21, April 2015). Retrieved from [http://gelpbrasil.com/wp-content/uploads/2015/05/smart\\_education\\_workshops\\_slides.pdf](http://gelpbrasil.com/wp-content/uploads/2015/05/smart_education_workshops_slides.pdf) (accessed 12 February 2017).
- Giffinger, R. (2007). *Smart Cities: Ranking of European Medium Sized Cities*. Retrieved from [http://www.smart-cities.eu/download/smart\\_cities\\_final\\_report.pdf](http://www.smart-cities.eu/download/smart_cities_final_report.pdf) (accessed 12 February 2017).
- Heinemann C., Uskov V.L. (2018). Smart University: Literature Review and Creative Analysis In: Uskov, V.L. Bakken, J.P., Howlett, R.J., Jain, L.C. (Eds.) (2018), *Smart Universities, Smart Innovation, Systems and Technologies*, pp. 11-46
- Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., and Ludgate, H. (2013). *NMC Horizon Report: 2013 Higher Education Edition*. Austin, Texas: The New Media Consortium. Retrieved from <https://files.eric.ed.gov/fulltext/ED559358.pdf>
- Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., and Hall, C. (2016). *NMC Horizon Report: 2016 Higher Education Edition*. Austin, Texas: The New Media Consortium. Retrieved from <http://cdn.nmc.org/media/2016-nmc-horizon-report-he-EN.pdf> (accessed 12 February 2018).
- Johnson, L., Adams Becker, S., Estrada, V., and Freeman, A. (2015). *NMC Horizon Report: 2015 Higher Education Edition*. Austin, Texas: The New Media Consortium. Retrieved from <http://cdn.nmc.org/media/2015-nmc-horizon-report-HE-EN.pdf>, <https://www.nmc.org/publication/nmc-horizon-report-2015-higher-education-edition/> (accessed 12 February 2018).
- Johnson, L., Adams Becker, S., Estrada, V., Freeman, A. (2014). *NMC Horizon Report: 2014 Higher Education Edition*. Austin, Texas: The New Media Consortium. Retrieved from <http://cdn.nmc.org/media/2014-nmc-horizon-report-he-EN-SC.pdf> (accessed 12 February 2018).
- Johnson, L., Adams, S., and Cummins, M. (2012). *The NMC Horizon Report: 2012 Higher Education Edition*. Austin, Texas: The New Media Consortium. Retrieved from <https://files.eric.ed.gov/fulltext/ED532397.pdf> (accessed 12 February 2018).
- Kwok, L.F. (2015). A vision for the development of i-campus, *Smart Learning Environments — a Springer Open Journal*, 2:2, Springer (2015)
- Kwok, L.M., Hui, Y.K. (2018). The role of e-portfolio for Smart Life Long Learning In: V.L.Uskov et al. (2018) *Smart Universities, Smart Innovation,*

- Systems and Technologies 70, Springer International Publishing AG 2018, pp. 327-355
- Roth-Berghofer, T. (2013). Smart University, the University as a Platform (2013). Retrieved from <https://smartuniversity.uwl.ac.uk/blog/?p=100> (accessed 12 February 2017).
- Smart Technology Applications in Business Environments (2017). Editor(s): Tomayess Issa (Curtin University, Australia), Piet Kommers (University of Twente, The Netherlands), Theodora Issa (Curtin University, Australia), Pedro Isaías (Portuguese Open University, Portugal), Touma B. Issa (Murdoch University, Australia) IGI Global ISBN13: 9781522524922; ISBN10: 1522524924; EISBN13: 9781522524939; Chapter 11 DOI: 10.4018/978-1-5225-2492-2.ch011 Retrieved from <http://www.igi-global.com/book/smart-technology-applications-business-environments/176067> (accessed 12 February 2017).
- Smarter education with IBM. Retrieved from [https://www-935.ibm.com/services/multimedia/Framework\\_-\\_Smarter\\_Education\\_With\\_IBM.pdf](https://www-935.ibm.com/services/multimedia/Framework_-_Smarter_Education_With_IBM.pdf) (accessed: 12 February 2018).
- Smyrnova-Trybulska, E. (2018). Technologie informacyjno-komunikacyjne i e-learning we współczesnej edukacji [Information and Communication Technologies and E-learning in Contemporary Education]. Katowice: Wydawnictwo Uniwersytetu Śląskiego. 572 s. ISSN 0208-6336 ISBN 978-83-226-3070-9 (print version) ISBN 978-83-226-3071-6 (digital version).
- Smyrnova-Trybulska, E., Morze, N. (2019). *Innovative MA Programme "E-learning in Cultural Diversity"* In: Eugenia Smyrnova-Trybulska, Piet Kommers, Natalia Morze, Josef Malach (Eds.) *Universities in the Networked Society. Cultural Diversity and Digital competences in Learning Communities*. Springer ISBN 978-3-030-05025-2 (in publishing)
- Smyrnova-Trybulska, E., Morze, N., Glazunova, O., (2017). Design of a University Learning Environment for SMART Education In Tomayess Issa (Curtin University, Australia), Piet Kommers (University of Twente, The Netherlands), Theodora Issa (Curtin University, Australia), Pedro Isaías (Portuguese Open University, Portugal), Touma B. Issa (Murdoch University, Australia) (eds). *Smart Technology Applications in Business Environments*. IGI Global ISBN13: 9781522524922; ISBN10: 1522524924; EISBN13: 9781522524939; Chapter 11 DOI: 10.4018/978-1-5225-2492-2.ch011 Retrieved from [www.igi-global.com/book/smart-technology-applications-business-environments/176067](http://www.igi-global.com/book/smart-technology-applications-business-environments/176067) p.221-248
- Tihomirova, N.V., (2012). Global'naa strategiya razvitiya smart-obshchestva. MESI na puti k Smart-universitetu. Retrieved from <http://smartmesi.blogspot.ru/2012/03/smart-smart.html> (accessed 8 September 2016).



- Tikhomirov, V., Dneprovskaya, N. (2015). Development of strategy for smart University. Open Education Global International Conference, Banff, Canada, 22–24 April 2015. In Uskov V., Bakken J., Pandey A., Singh U., Yamalanchili M., Penumatsa A., 2016: Smart University Taxonomy: Features, Components, Systems. In Uskov V., Howlett R.J., Jain L.C., (eds.). Smart Education and e-Learning. Berlin: Springer, pp. 3–14.
- UNESCO (2002). Universal Declaration on Cultural Diversity.
- Uskov, V., Bakken J., Pandey A., Singh U., Yamalanchili M., Penumatsa A., (2016). Smart University Taxonomy: Features, Components, Systems. In V.Uskov, R.J.Howlett, L.C. Jain (eds.) Smart Education and e-Learning. Berlin: Springer, s. 3–14.
- Uskov, V.L. Bakken, J.P., Howlett, R.J., Jain, L.C. (Eds.) (2018), Smart Universities, Smart Innovation, Systems and Technologies 70, DOI 10.1007/978-3-319-59454-5\_2